



**US Army Corps  
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*Ecosystem Management and Restoration Research Program*

## **The Corps of Engineers and Prairie Restoration:**

Synopsis of the First Corps Prairie Workshop, Follow-up Actions, and Thoughts on the Future of Prairie Restoration and Management on Operational Projects

Chester O. Martin, E. Paul Peloquin, Pamela Bailey,  
Michael A. Watkins, and Mandy E. Like

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**Abstract:** The restoration of native prairie ecosystems has emerged as an important natural resources land management issue on many Corps of Engineers operational projects. A Corps-wide data call in 2004-2005 revealed that at least 21 Districts and 172 projects were involved to some extent in prairie/grassland restoration and management efforts. A need was recognized for greater attention to managing grassland ecosystems on Corp projects, and the first Corps of Engineers Prairie Workshop was held in Manhattan, Kansas, in August 2006. The workshop included 13 presentations by prairie enthusiasts representing the Corps, other government agencies, and private organizations. Presentations focused on management issues and a variety of approaches and associated techniques for prairie restoration (e.g., site conversion, prescribed burning, invasive species control, management of endangered species, and formation of partnerships). Follow-up actions resulting from the workshop included news releases, bulletin articles, conference presentations, and e-mail comments from participants. Finally, the future of prairie restoration and management on Corps projects was discussed. Major challenges include conflicting management philosophies and priorities, a need for improved technology, better communication within and outside the Corps, and a critical need to conduct thorough inventories of grassland habitats on operational projects.

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## Preface

This work was conducted by the Environmental Laboratory (EL), U.S. Army Engineer Research and Development Center (ERDC), for the Corps of Engineers Ecosystem Management and Restoration Research Program (EMRRP). The work unit title was “Prairie/Grassland Ecosystems on Corps of Engineers Projects.” Chester O. Martin, EL, was Principal Investigator for the work unit. EMRRP Program Manager was Glenn Rhett, EL.

The Corps of Engineers Stewardship Advisory Team (SAT) provided technical support and direction for all aspects of the prairie restoration study. Thanks go to all members of the SAT and especially to E. Paul Peloquin, Northwestern Division; Donald Wiese, Fort Worth District; Michael Watkins, Kansas City District; and Angie Huebner, Jacksonville District, for providing technical and administrative guidance. Additionally, the authors wish to thank all presenters at the Corps Prairie Workshop held in Manhattan, Kansas, and project and District personnel who provided letter and e-mail comments regarding the workshop. Photographs were provided by Pamela Bailey, EL; Michael Watkins, Jim Brown and Matt Beckman, Kansas City District; Carey Weber, Fort Worth District; Randall Becker, Little Rock District; Wes Messinger, Portland District; and Richard Wynia, Natural Resources Conservation Service. This technical report was reviewed by Scott Jackson, Dr. David L. Price, and Dr. Richard A. Fischer, EL.

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COL Gary E. Johnston was Commander and Executive Director of ERDC. Dr. James R. Houston was Director.

## Unit Conversion Factors

Multiply	By	To Obtain
acres	4,046.873	square meters
feet	0.3048	meters
miles (U.S. statute)	1,609.347	meters

# 1 Introduction and Purpose

The restoration of native prairie has emerged as an important issue relevant to many U.S. Army Corps of Engineers Districts. Prairie grasslands contribute significantly to erosion control, sediment management, and control of non-point source pollution, and both groundwater and surface water systems that drain through prairie regions can affect the performance of flood control, navigation, and hydropower projects. Additionally, prairie habitats provide important wildlife and recreational benefits to Corps project lands (Martin and Peloquin 2005; Martin et al. 2008) (Figure 1). In 2004 a study was approved to examine the status of prairies on Corps lands and determine research needs pertinent to operational projects. The study was sponsored by the Corps Ecosystem Management and Restoration Research Program (EMRRP). Guidance was provided by the Corps Stewardship Advisory Team (SAT) throughout the study.



Figure 1. Prairie restoration provides important natural resource benefits on Corps projects in many regions.

Objectives of the EMRRP study were to establish the national importance of grassland ecosystems on Corps projects, identify the approximate acreage of prairie/grassland types, outline the Corps' potential role in grassland management, evaluate opportunities for future actions, and



identify potential research that would benefit the Corps in prairie restoration and management. Work unit tasks included (1) a survey of operational projects to determine the amount, types, and distribution of grasslands throughout the Corps, (2) a Corps prairie workshop for District and project personnel, and (3) a series of technical notes on specific aspects of prairie restoration and management. The first task was accomplished with the assistance of the SAT via a Corps-wide data call in 2004 and 2005. Results of the survey revealed that at least 21 Districts and 172 lake projects were involved in prairie/grassland restoration and management efforts to some extent; thus a need was recognized for greater attention to managing these ecosystems on Corps projects (Martin and Peloquin 2005).

The second major task for the work unit was a Corps-wide workshop designed to provide technology on prairie restoration and management techniques and share information among natural resources personnel involved in prairie/grassland management. This technical note provides a synthesis of workshop activities and presentations. A description of follow-up actions including e-mail responses by workshop participants, bulletins and news releases, and presentations at other workshops and conferences is also provided. Finally, prairie needs on Corps projects are summarized, and the future of prairie restoration and management on Corps lands is assessed.

## **2 First Corps of Engineers Prairie Workshop**

The first Corps of Engineers prairie workshop was held in Manhattan, Kansas, on 15-16 August 2006. The workshop was attended by 40 Corps personnel and representatives from other agencies and organizations, including the U.S. Fish and Wildlife Service (USFWS), Natural Resources Conservation Service (NRCS) Manhattan Plant Materials Center, Kansas Natural Heritage Inventory (KSNHI), U.S. Army Fort Riley, and Baker University. The Environmental Laboratory (EL), U.S. Army Engineer Research and Development Center (ERDC), and the Operations Division, U.S. Army Engineer Kansas City District (KCD), co-sponsored the event. The workshop was a product of the EMRRP.

The workshop included presentations by prairie enthusiasts inside and outside the Corps. Site visits were made to the internationally acclaimed Konza Prairie, prairie restoration projects on KCD's Tuttle Creek Lake and Milford Lake, and Fort Riley. Workshop coordinators were Pamela Bailey and Chester Martin, ERDC, and Michael Watkins, KCD. Field events were organized and conducted by Watkins and KCD project staff. Presentation titles and speakers are listed below (not necessarily in the order presented at the workshop), and presentations are summarized in the following paragraphs. Full accounts of the workshop presentations may be found at the Corps Gateway website (<http://corpslakes.usace.army.mil>).

### **Presentation titles and speakers**

- Survey of Prairie Ecosystems on Corps of Engineers Projects – Chester O. Martin, ERDC
- Overview of Corps Policy and Application – E. Paul Peloquin, Northwestern Division (NWD)
- Brome Conversion to Native Prairie – Jim Brown, Harlan County Lake, KCD
- Preventing Strip Disking Unbroken Native Prairie – Dan Hays, Wilson Lake, KCD
- Partnerships with Rural Volunteer Fire Departments to Conduct Safe Prescribed Burns – Matt Beckman, Perry Lake, KCD
- Life and Death in the Texas Blacklands: The Granger Prairie Project – Carey Weber, Lake Georgetown, Fort Worth District (SWF)

- Grassland Management Issues at Highly Urbanized Lakes in Texas – Don Wiese, SWF
- Management of the Saratoga Blackland Prairie at Millwood Lake and Glade Management on the White River Projects in Arkansas – Randy Becker, Little Rock District
- Managing Willamette Valley Prairies – Wes Messinger, Portland District
- The Kansas Natural Heritage Inventory and Statewide Rare Plant Surveys – Jennifer Delisle, KSNHI
- The Tallgrass Legacy Alliance – Jim Minnerath, USFWS
- Helping People Help the Land – Richard Wynia, NRCS Manhattan Plant Materials Center
- Wet Meadow Restoration at the Baker Wetlands – Roger Boyd, Baker University

## **Synopsis of presentations**

### **Survey of prairie ecosystems**

The meeting was initiated with a summary of the results of a survey of prairie/grassland areas on Corps operational projects. The survey was completed in 2005 as a product of the EMRRP work unit titled “Prairie/Grassland Ecosystems on Corps Projects” (Martin et al. 2006). The study showed that prairie systems contribute significantly to natural resource stewardship objectives on Corps projects. The Martin et al. (2006) Technical Note summarized data from 19 Districts and 151 projects. However, additional data received in 2007 revealed that at least 21 Districts and 172 projects are involved in prairie/grassland management efforts on nearly 800,000 acres (Martin et al. 2008). Acreage estimates for each District are summarized in Appendix A. The largest amount of prairie occurs in the Northwestern Division, which contains approximately 600,000 acres. Although prairie restoration and management activities are concentrated in the Midwest, Great Plains, and southwestern regions, it is important that many projects in the East have begun to convert open lands to native grasses and forbs.

Benefits of prairie restoration efforts noted by Corps personnel included erosion control, sediment management, control of non-point source pollution, improvement of water quality, restoration of degraded aquatic habitats, protection of rare species, and improvement of wildlife habitat.

Research elements for the study were discussed, and it was emphasized that input from Corps field elements was essential to developing user products that would benefit prairie restoration efforts on project lands. Furthermore, development of appropriate grassland management practices on project lands provides the Corps with an opportunity to make a major contribution to protecting remaining stands of one of the most endangered ecosystems in North America.

Martin concluded that information is needed to promote prairie restoration from a national perspective on Corps lands, and regional guidelines are needed in regard to the technical aspects of planning, restoring, and maintaining prairie ecosystems. It was apparent from the 2004-2005 survey that an EMRRP work unit dedicated specifically to prairie/grassland ecosystems would provide numerous benefits to the Corps' natural resources management program.

### **Corps policy and application**

Paul Peloquin provided an overview of policy and national programs related to prairies. He emphasized that native prairie is a significant resource that is dwindling nationwide both in quantity and quality. Peloquin stated that although prairie lands on Corps projects are not protected by law, Corps natural resources personnel are working to learn what kind of management is best for prairie preservation. Prairie lands are subject to many stressors, especially invasive plant species. The Corps is collaborating with outside agencies to develop guidelines for restoration and management, which must address six areas of national importance: mitigation, endangered species, cultural resources, master planning, inventory, and sustainability.

Peloquin emphasized that it is important for natural resources managers to realize that they can have input into making Corps prairie policy. He stated that "we're working to address critical areas of national importance to the Environmental Stewardship Business Line through the development of regulations, budget Engineering Circulars, the SAT membership, task forces, and execution of the natural resources program at all levels (from the project through the District to HQUSACE)." Of the six performance measures important to the natural resources manager in managing Corps lands and waters, prairies are best represented by the "Healthy and Sustainable Lands and Waters" measure.

### **Brome conversion to native prairie**

Jim Brown presented an account of historical land use practices and an evolution of change in management philosophy at Harlan County Lake, Nebraska. Harlan County Lake, vintage 1952, is the second-oldest lake project in KCD. Much of the grassland acreage on the project was originally leased to adjacent landowners and there was little Corps supervision regarding management practices such as cropping systems and cattle grazing. Also, the Corps' focus at the time was on tree planting and development of parks and boat ramps. In the late 1970s and early 1980s a series of public meetings resulted in the Corps enforcing regulations on crop rotation and removal of grazing.

Changes included the installation of 100-ft-wide warm-season native grass strips between each agricultural field. This was an initial success but by the early 1990s the fields had become rank and unmanageable and woody species such as eastern red cedar (*Juniperus virginiana*), Russian olive (*Elaeagnus angustifolia*), and green ash (*Fraxinus pensylvanica*) had invaded grassland sites. Management priorities shifted to grassland management in the mid-1990s and meetings with the Nebraska Game and Parks Commission (NGPC) resulted in a partnership titled "Focus on Pheasants." This brought about the conversion of smooth brome (*Bromus inermis*) fields to warm-season native grassland habitat demonstration areas. Geographic information system (GIS) data were used to help delineate grasslands and manage resources. Changes in the agricultural lease program included an increase in the width of grass strips, establishment of grass blocks, conversion of croplands to idle fields, and development of a new haying paradigm. These changes were made to improve the existing prairie ecosystem and specifically to provide habitat for ring-necked pheasants (*Phasianus colchicus*).

Increases in grass strips, grass blocks, and idle fields have substantially improved habitat conditions for pheasants and many other species of grassland birds (Figure 2). Attempts were made to create 40-acre grass blocks, which are considered optimal for pheasant brood-rearing habitat, but it was not always possible to put that much land aside. Idle fields consisted of 5- to 15-acre blocks centered in row crop areas. Studies are presently being conducted by the University of Oklahoma and University of South Dakota to determine songbird use of these plots. The new haying program called for haying every five years or as needed rather than haying annually on a continuous basis. Other prairie restoration practices

employed on Harlan Lake sites include herbicide treatments, grassland interseeding, managed crop rotations, experimentation with soil banks, disking (only on previously broken land consisting of non-native species), tree removal, and prescribed burning. Project personnel will continue to work with state and other-agency personnel to restore native grasslands on the Harlan Lake project.



Figure 2. Grass strips and blocks have improved habitat conditions for pheasants and songbirds at Harlan County Lake, Nebraska (Jim Brown photo).

### **Prevention of strip disking**

Dan Hays described issues with prairie management practices on Kanopolis Lake, Kansas. Kanopolis Lake is the oldest lake in the Kansas City District (KCD) and is composed of approximately 20,000 acres of land and 3,000 acres of water. The project includes 4,900 acres of grassland, 4,200 acres of which are unbroken native prairie. Prairie management practices approved by the district include prescribed fire, haying, and short-season grazing (cattle only). Approximately 5,000 acres of wildlife lands are leased to the Kansas Department of Wildlife and Parks (KDWP).

Hays discussed a major controversy that arose in the late 1990s when the KDWP decided to strip disk grassland areas without the approval of the

Kansas City District. Approximately 25 acres of a 250-acre tract were subjected to random disk lines from 25 to 30 ft wide. Additionally, five 5-acre areas were cultivated to food plots. KDWP contended that strip disking was necessary for forb production to attract soft-bodied insects, which pheasant broods need to survive. A district inspection of the area revealed that strips did not follow contours and that most of the strips were in class 5 and 6 soils, which are deemed unsuitable for cultivation. Also, one of the food plots infringed upon a cultural site proposed for inclusion in the National Registry.

An advisory panel composed of rangeland experts from the NRCS, Kansas State University, and Kansas Biological Survey was convened to examine the problem and make recommendations for future action. The panel concluded that the KDWP did not have an adequate plan with firm objectives and goals and they did not have an adequate evaluation process for their actions. Thus, it was recommended that strip disking cease immediately. The Corps was also criticized for lack of oversight responsibility and not requiring planning documents and coordination. The outcome of this incident was a lesson in coordination needs and conflict resolution. It increased awareness of the importance of prairie ecosystems, heightened the priority of natural resource management programs, increased awareness of the need for carefully worded planning documents, and improved interagency communications. The KCD and KDWP now meet annually to address work plans.

#### **Partnerships with rural volunteer fire departments**

Matt Beckman gave a presentation dealing with safe burning techniques that have been implemented at Perry Lake, located in the Glacial Hills Region of northeast Kansas, KCD. Prior to establishing burning regulations for the project there were many concerns, including limited staff and lack of proper equipment needed to contain the large amounts of potential fuel deposits. To resolve these problems, project personnel solicited help from the local Jefferson County Fire Department. The five main fire departments of Jefferson County were eager to help burn, mainly because the exercise would provide fire training to new recruits and onsite training for the department as a whole. The goals set by the Corps and the participating fire departments were to: 1) manage the land to enhance native grass stands; 2) control the invasion of woody species; 3) reduce timber deposited by floods; 4) conduct safe and successful prescribed burns; 5) and provide training opportunities.



Prescribed burns in the region typically are scheduled from the first of March to the first of May. Organizing a burn depends primarily on weather conditions, which are not known until about 2-3 days before a burn is scheduled. Beckman emphasized that a pre-burn plan meeting is held before each burn. The pre-burn meeting establishes teams, determines the location of fire lines and breaks, and determines how the head fires will be set (Figure 3). Maps are developed detailing exactly where and when burns will take place; they are then distributed to all local Sheriffs' departments to enable them to alert citizens when or if the fires are reported. Additionally, firebreak lines are mowed; natural breaks such as creeks and roads are used whenever possible.



Figure 3. A head fire set for a prescribed burn on Perry Lake, Kansas (Mike Watkins photo).

Beckmann outlined the following steps for a burn plan:

- Locate beginning of burn on map the day of the burn
- Ensure a minimum crew of four
- Ensure availability of proper equipment
- Verify local weather conditions with the National Weather Service
- Check Rangeland Fire Index (information provided by the National Weather Service on the potential for wildfires)
- Provide Safety Plan: An on-site safety meeting will be held to discuss predicted weather patterns, escape routes, safety zones, smoke management, and other pertinent safety issues



- Afterwards, a post-burn evaluation is conducted by natural resource specialists to determine if anything should be done differently due to conditions such as weather and fuel.

The first burn on Perry Lake using rural fire department personnel was successfully accomplished in March 2005. Approximately 25 volunteers, six trucks, and two tankers showed up to help with the prescribed burn of 177 acres. In 2005, three burn events were conducted with a total of 400 acres being burned. In 2006, five burns were planned for 760 acres, with burns on 689 acres actually accomplished. The partnership with volunteer fire departments has been extremely successful (Figure 4), and Perry Lake plans to continue using the volunteers to accomplish prescribed burns to improve prairie lands on the project.



Figure 4. A pre-burn meeting of volunteer fire department personnel at Perry Lake, Kansas (Matt Beckman photo).

### **Life and death in the Texas Blacklands**

The Fort Worth District has been involved in the management of native prairies at Lake Georgetown and Granger Lake in central Texas since the early 1990s (Figure 5). Carey Weber provided an account of the effects of past and present farming practices in the central Texas Blackland Prairie region and described efforts by the Corps of Engineers to preserve remnant patches of native prairie. A gene bank of disappearing local genotypes of prairie plants has been established at Granger Lake, resulting in one of the best replication sites in the area.



Figure 5. Native prairie remnants at Granger Lake, Texas, support a diversity of native grasses and forbs (Chester Martin photo).

The prairie region of central Texas has been extensively hayed, plowed, grazed, and urbanized, and Williamson County is now one of the fastest growing areas in Texas. The blackland prairie area is approximately 25 miles wide in the eastern half of the county and presently consists of isolated patches of remnant prairie habitat. Typical roadside management includes planting Bermuda grass (*Cynodon dactylon*) and control of Johnson grass (*Sorghum halepense*) with herbicides. The Granger Lake project, located in Williamson County, is a relatively new flood control project that includes land areas that historically supported native prairie plants. However, virtually the entire project had been plowed or planted to non-native vegetation prior to purchase by the Corps in the 1970s. Nevertheless, project personnel realized the value of converting disturbed lands to native grasslands, and in 1990 a partnership was developed with other agencies and organizations to establish replication sites and a gene bank on Granger Lake (Figure 6).

Granger Lake personnel met with potential partners in 1990 to garner support and share ideas regarding re-establishment of native prairie on project lands. The resulting plan consisted of developing replication sites and establishing a gene bank. Grassland areas were surveyed and four relic sites were identified that had never been subjected to plowing. These sites were safe from construction activities and not in danger of inundation by lake floodwaters. After designating the sites as prairie replication sites, they were added to the existing Texas Parks and Wildlife (TPWD) license outgrant agreement with the understanding that they would be managed



Figure 6. Prairie partnership at the Granger Lake Project (Carey Weber photo).

as intended. Some of the sites had become overgrown with weedy species such as Roosevelt weed (*Baccharis neglecta*); thus mowing and burning were required for restoration. Examples of native species identified on the sites include purple coneflower (*Echinacea* sp.), Florida paspalum (*Paspalum floridanum*), and rattlesnake master (*Eryngium yuccifolium*). Additionally, grass and herbaceous species were planted using regional stock from commercial suppliers. Fortunately, the project was able to obtain the last commercially produced seed of Texas bluebells (*Eustoma grandiflorum*), which has resulted in one of the best stands in the area.

Species were added by obtaining plant material available from local sources, and the gene bank established on the relict sites now has more than 1,000 genotypes. Public donors included the NRCS, Texas Department of Transportation, Native Plant Association of Texas (NPAT), and Williamson County Knox City Plant Material Center. Existing populations of native plants were located along roadsides, in waste areas, and on private property, and transplanted to the replication sites during the fall. Replication sites are now being managed and a variety of experiments are being conducted by private groups under formal agreements. The NPAT has been monitoring sites and selected species for approximately 16 years. Weber concluded by stressing that programs such as those established on Granger Lake require a long-term commitment by project personnel and non-government partners. Additionally, results should be shared, celebrated, and used to communicate with and educate the public.

### **Grassland management at urbanized lakes**

Don Wiese discussed challenges that the Corps faces in trying to manage habitat in highly urbanized areas. He focused on shoreline vegetation management at Lewisville and Grapevine Lakes, located in north-central Texas in the Dallas-Fort Worth metroplex. Nineteen incorporated cities border the area between the lakes, and development has recently intensified in the region, creating additional problems with shoreline management. Lewisville Lake has 187 shoreline miles, and Grapevine Lake has 60 shoreline miles. A major concern is adjacent property owners who insist on mowing and clearing underbrush to the edge of the lake.

Original mowing guidelines for the projects allowed home owners to mow 25 ft toward the shoreline on government land at Grapevine Lake and 50 ft toward the shoreline at Lewisville Lake. However, there was a strong tendency for residents to mow and remove underbrush virtually to the water's edge to get a better view of the lake. There were even cases where home owners would mow in the dark of night to prevent detection. However, Corps regulation ER 1130-2-406 states that "the Corps must balance permitted private uses with resource protection for general public use." The Fort Worth District realized that the situation had gotten out of hand and something had to be done. Unfortunately at the time there was a perception of inconsistent enforcement by the Corps, which was actually a cessation of enforcement for several years due to inadequate ranger personnel assigned to work the shorelines.

The first step by the Corps to remedy the problem was to issue a new policy that allowed mowing only 15 ft toward the shoreline on both lakes. However, this resulted in a serious backlash, and the residents formed a Homeowners Shoreline Alliance and hired an attorney to challenge the new mowing policy. Conversely, the U.S. Fish and Wildlife Service wanted homeowners to cease mowing entirely on government property. The revised plan of action consisted of an aggressive public outreach campaign designed to (1) inform the public and gather comments, (2) develop mowing and underbrushing alternatives to be evaluated in an environmental assessment, and (3) prepare an ecosystem-based vegetation management prescription. The assessment was conducted in a workshop environment. Corps personnel also met with city representatives and provided news releases. The revised action plan established a zone concept that would be applicable to all homeowners. The goal of the new guidelines was to allow a reasonable mowing and underbrushing zone adjacent to

home sites, but prevent mowing and brush removal in a habitat management zone that would support native vegetation and provide sustainable wildlife habitat.

### **Blackland Prairie and glade management in Arkansas**

Randall Becker discussed prairie management on three projects in the Little Rock District: Millwood Lake in southwestern Arkansas, and Bull Shoals Lake and Beaver Lake on the White River in northern Arkansas. A tract of the nationally important Saratoga Blackland Prairie that occurs on Millwood Lake has been managed since 1987 through a cooperative agreement with the Arkansas National Heritage Commission and The Nature Conservancy (Figure 7). The soil substrate of the prairie is Saratoga Chalk, a unique calcareous soil developed from deposits of prehistoric mollusk shells during the Cretaceous Period. The prairie supports a diversity of plants, including wild hyacinth (*Camassia scilloides*), larkspurs (*Delphinium* spp.), beard-tongue (*Pentstemon* spp.), auriculate false foxglove (*Agalinus auriculata*), and false guara (*Stenosiphon linifolius*). Prescribed burns in the blackland prairie are typically dormant or cool season burns conducted from December to March, preferably on two-year rotations. The objective of winter burns on Millwood Lake is to perpetuate growth of false guara, a state-threatened species in Arkansas.

Dolomite limestone glades are characteristic features of Bull Shoals and Beaver Lakes (Figure 8). These sites occur at about 600 ft elevation and are highly eroded. Sensitive species occurring in glade habitats include the collared lizard (*Crotaphytus collaris*) and larkspurs. Trelease's larkspur and Moore's delphinium (*Delphinium newtonianum*) are examples of rare species that occur on these sites. Prescribed fire is needed to control invasive woody species, especially eastern red cedar (*Juniperus virginianum*) and sumac (*Rhus* spp.), and maintain the herbaceous character of glades. Hot, summer burns are conducted during the growing season to knock back the woody species because cool season burns are not adequate to control invasive plants. Ideally, sites are burned every two years, but three-year intervals may be required to build up enough fuel to run a hot fire through glade habitats.





Figure 7. A high quality blackland prairie tract resulting from proper management on Millwood Lake, Arkansas (photo courtesy of Douglas Zollner, The Nature Conservancy).



Figure 8. Dolomite limestone glades provide habitat for several sensitive species (Randall Becker/Bruce Caldwell photo).

Beyond five years, woody vegetation must be removed and the entire process may have to be reinitiated. Post oak savanna also occurs on Bull

Shoals Lake. The grassland understory in this habitat is used by the Henslow's sparrow (*Ammodramus henslowii*), an Arkansas species of conservation concern. The Henslow's sparrow requires at least two years of grass buildup for nest construction, thus a fire regime of 3-5 years is required to provide nesting habitat.

Beaver Lake is located along the headwaters of the White River, where limestone glades are characterized by thicker soils with rock outcroppings. Missouri bladderpod (*Lesquerella filiformis*), a federally listed species, and Ozark corn salad (*Valerianella ozarkana*), a state species of concern, occur only in southern Missouri and northwestern Arkansas and are featured species on the project. Missouri bladderpod was discovered at Beaver Lake in 2005 on a south-facing slope near a closed recreation area. The site was covered with Japanese honeysuckle (*Lonicera japonica*) and the project contracted with The Nature Conservancy to mechanically remove invasive species in the fall of 2005. Because of the difficult location, management must be determined from careful monitoring. Mechanical removal and herbicides are options, whereas prescribed burning is the preferred alternative. Both the bladderpod and corn salad responded well to the treatment. August is considered the best time to burn glades to control woody plants and aggressive invasive grasses. In conclusion, long-term management is required to effectively improve and sustain native prairie habitat. Managers must be dedicated to the prescribed burn regime to obtain proper results.

### **Managing Willamette Valley prairies**

The prairies of western Oregon are among the rarest plant communities in North America. The ecology and management of Willamette Valley prairies was described by Wes Messinger. The Willamette Valley is located west of the Cascade crest in Oregon in an essentially maritime climate. Over 40 in. of rain falls in the area annually, primarily between October and June, and drought conditions occur in the summer. Important remnants of both Willamette Valley wetland and upland prairies are actively managed by the Corps of Engineers Portland District. Wetland prairies in the region are high-quality remnants that primarily require routine maintenance, whereas uplands are degraded sites that harbor important species and require more comprehensive treatments. Although the loss of mid-continent prairies has been recognized as a problem since the 1930s, concern for the Willamette Valley wet prairie and development of management and restoration techniques only date from the 1980s.

To understand the status of present Willamette Valley prairie conditions, it is necessary to look back in time. Some 10,000 years ago there was a warm period following glaciation that promoted the establishment of grasslands. Then, 7,000 years ago, Mount Mazama exploded, leaving Crater Lake and a layer of ash that remains as an impermeable clay layer below the wet prairies. As the climate cooled, frequent fires maintained the prairie against tree invasion. Later, 160 years ago, a farming civilization arrived in the West, which resulted in the suppression of fires and eventual conversion of 99 percent of the original prairie to wheat and rye grass fields. Modern civilization has subsequently transformed much of the area to housing and urban development. Currently, there are very few high quality prairie remnants and these are managed by various public agencies and The Nature Conservancy.

Wetland prairies managed by the Corps are dominated by tufted hairgrass (*Deschampsia caespitosa*) and support about 200 plant species, including two federally listed species and many plants on state heritage lists. Existing habitat fragments contain abundant remnants of important populations and processes. Maintaining the role of fire in the ecosystem and managing invasive and exotic plant species are the primary restoration and management needs of these sites (Figure 9). Prescribed burning is carefully managed because fire functions to reduce exotic and native woody vegetation and promotes populations of certain rare species, but it may also increase the risk of invasion by some exotic species. Burning is achieved through an Economy Act Agreement with the Eugene District office of the Bureau of Land Management. Mechanical treatment (primarily mowing), manual treatment, and herbicide treatments are used to supplement the burning program. Herbicides are primarily used to control reed canary grass (*Phalaris arundinacea*) and as a cut stump treatment.

While wet prairies are important remnants of relatively intact plant communities, Willamette Valley upland sites tend to be heavily degraded, with only patches of important features. The sites are currently dominated by exotic European grasses, but there is a moderate diversity of native forbs, including several rare species. Two sets of techniques are employed on upland sites; one set promotes habitat quality for listed species in existing vegetation, and the other is intended to completely replace existing vegetation with restored prairie.





Figure 9. Fire is important for reducing woody species in Willamette Valley prairies (Wes Messinger photo).

Upland prairie management methods include fall mowing to reduce brush, spring mowing to reduce tall oatgrass (*Arrhenatherum elatus*), manual treatment, herbicide applications, culturing of host and native nectar plants, and site restoration. Listed species are currently the primary target of upland prairie restoration. Sustaining and increasing populations of the endangered Fender's blue butterfly (*Icaricia icarioides fenderi*) and its rare host plant, Kincaid's lupine (*Lupinus sulphureus* var. *kincaidii*), is an example of a specific management program (Figure 10). Management strategies for this effort include promoting and maintaining low-stature vegetation, controlling aggressive exotic plants, increasing host and nectar plant populations, restoring native prairie in unoccupied areas, and reintroducing host plants to restored prairie. Site restoration is initiated with removal of existing vegetation. The next round of adaptation is moving to a repeat broadcast herbicide treatment, followed by drilling selected species of native grass seed. There will then be at least one season of follow-up chemical, mechanical, and manual weed treatment prior to introducing plant diversity. Only after prairie quality is high (up to three years of weed control activity) will we introduce listed species.

Responsible stewardship of these important sites is clearly a continuing challenge. Unmet challenges are both biological and bureaucratic. For example, how will the conflict between maintaining fire's function and its

tendency to promote exotic components of the system be managed? And how will stewardship responsibilities continue to be met in the face of changing budgets and management priorities? Nevertheless, The Portland District plans to continue to play a leadership role in maintaining and restoring Willamette Valley prairie ecosystems. Land use designations will be emphasized in master plans, extension of Research Natural Areas, district support of Critical Habitat Designation on most prairie sites, and continuation of close partnerships with the state fish and wildlife agency on licensed lands.



Figure 10. Prairie management in the Willamette Valley includes a program to benefit populations of the Fender's blue butterfly and its host plant Kincaid's lupine (Wes Messinger photo).

### **The Kansas Natural Heritage Inventory and statewide rare plant surveys**

The Kansas Natural Heritage Inventory (KSNHI) is a research program of the Kansas Biological Survey (KBS). The KBS is housed at the University of Kansas in Lawrence; established in the early 1900s, it was originally a state agency, but is now incorporated into the University. It is composed of many different programs such as the Central Plains Center for Bio-Assessment, the Kansas Applied Remote Sensing Program, the Kansas Field Station and Ecological Reserve, and the KSNHI. Jennifer Delisle, Information Manager for the KSNHI, discussed the program and what it has done specifically for native prairies in eastern Kansas.

The mission of the KSNHI is to collect, manage, and disseminate information about the biological diversity of the state. The KSNHI is a contributing member of NatureServe, a network consisting of natural heritage programs and conservation data centers throughout the United States, Canada, and Latin America. NatureServe provides multi-jurisdictional datasets designed to fit the needs of federal and private clients throughout the network.

The KSNHI undertakes site-specific biological inventories to determine the presence and status of threatened, endangered, and other sensitive species. General floral and faunal inventories also are conducted, and natural communities are characterized (Figure 11). A statewide database is maintained with access to information on species that are considered rare and in need of protection. By using NatureServe it is possible to find a list of imperiled and critically imperiled plants, animals, and habitats that occur in specific areas of the state. This information can also be used when trying to find a particular species.



Figure 11. Floral surveys are conducted to determine the presence of sensitive plants (Kansas National Heritage Inventory photo).

The KSNHI focuses most of its conservation work on habitat types, including different types of prairies. Tracts of prairie are located by conducting field reconnaissance surveys of a region and analyzing aerial photographs. A plant species list is then created for the sites and they are ranked for ecological integrity using the Heritage Program methodology. Rare plants and animals are documented, but habitat is the primary focus.

A primary goal of the KSNHI is to cooperate with other agencies so that it can protect historical prairie sites and support other restoration projects.

Since the KSNHI is a non-regulatory agency, it is only able to make recommendations regarding protection of prairie habitat and sensitive species. Thus, the KSNHI works closely with the U.S. Fish and Wildlife Service (USFWS) and is interested in building relationships with other agencies, including the U.S. Army Corps of Engineers. The agency also conducts wetland and prairie research and is a partner in the Tallgrass Prairie Conservation and Restoration Initiative at the University of Kansas field station.

### **Tallgrass Legacy Alliance**

Jim Minnerath of the U.S. Fish and Wildlife Service (USFWS) presented information on the Tallgrass Legacy Alliance (TLA), an alliance of agricultural and environmental organizations and individuals formed to facilitate greater understanding, appreciation, and preservation of the Flint Hills of Kansas and Oklahoma. The TLA originated in 1999 with a core group of ranchers and environmentalists. The stated mission of the TLA is to conserve and enhance the biological, economic, and cultural integrity of the tallgrass prairie through a coalition of ranchers, environmental organizations and public agencies. From the beginning, the TLA included the ranching community because it was believed that private land owners were going to be the backbone of the Flint Hills operation. Issues addressed by the TLA include fragmentation; invasive species; lack of ranch profitability; lack of financial incentives from private, state, or federal sponsors to maintain tallgrass prairie in a sustainable manner; loss of native species; and the associated social, fiscal, and biological implications of those problems.

The TLA has had many accomplishments. It has developed a new level of cooperation among diverse groups such as the Kansas Livestock Association, The Nature Conservancy, Kansas Department of Wildlife and Parks, Farm Bureau, USFWS, and many others. The TLA has also facilitated development and implementation of conservation easement programs and was an active participant in the Farm Bill program designed through the Wildlife Management Institute. Management strategies provided to ranchers include guidelines for removal of woody species, patch burning, and building and removal of fences as needed. Creative grazing systems are encouraged to promote heterogeneity; these include

multiple grazing regimes, rotational grazing, alternative watering systems, prescribed fire, multi-species grazing, and patch burning. The Alliance has been responsible for the establishment of habitat enhancement programs for 200,000 acres.

The TLA feels that one of its most significant accomplishments is increasing awareness and support for tallgrass prairies. The TLA plans to continue work on issues such as promoting conservation easements, reducing fragmentation, and increasing heterogeneity. Tallgrass prairie issues will continue to be a top priority for the TLA with hopes of extending its efforts into the northern Kansas Flint Hills and the southern Flint Hills of Oklahoma. Minnerath concluded that through the TLA, opportunities for community-based cooperative conservation in the Flint Hills region are as boundless as the imagination.

### **Helping people help the land**

The Manhattan Plant Materials Center (PMC) is one of a network of Natural Resources Conservation Service (NRCS) plant centers dedicated to providing vegetative solutions to conservation problems. Richard Wynia, Manhattan PMC Manager, provided an overview of the Center and discussed current activities and their contributions to prairie restoration. The Manhattan PMC serves a diverse region of the heartland including Kansas, Nebraska, northern Oklahoma, and eastern Colorado. The primary focus of the Center is to develop hardy, desirable plants that have the ability to survive and prosper under adverse conditions. Plants released by the Center can be used to conserve highly erosive sites, provide improvements in range and pasture plantings, produce field and farmstead buffers, improve air and water quality, and improve wetland and wildlife habitats.

The Manhattan Center mainly deals with cultivars, primarily of native grasses and forbs. Wynia described the Center's process for plant collection, growth and testing in nurseries, and selection for release, storage, and distribution to commercial seed producers. Species that PMC commonly works with include switchgrass (*Panicum virgatum*), little bluestem (*Schizachyrium scoparium*), sand bluestem (*Andropogon hallii*), sideoats grama (*Bouteloua curtipendula*) (Figure 12), Midas false sunflower (*Heliopsis helianthoides*), Eureka thickspike gayfeather (*Liatris pycnostachya*), sunglow gray head prairie coneflower (*Ratibida pinnata*), and partridge pea (*Cassia fasciculata*). Plants currently under develop-



ment include false indigo (*Amorpha fruticosa*), common buttonbush (*Cephalanthus occidentalis*), and bur oak (*Quercus macrocarpa*).

Other programs of the Center include the development of shoreline and streambank stabilization techniques and critical area revegetation, which requires the establishment of salt-tolerant species such as alkali sacaton (*Sporobolus airoides*), big sacaton (*Sporobolus wrightii*), inland saltgrass (*Distichlis spicata*), and four-wing saltbush (*Atriplex canescens*). The Center also works to improve plant biodiversity and increase the propagation potential of threatened and endangered species such as



Figure 12. Sideoats grama test plot on NRCS Manhattan Plant Materials Center (Richard Wynia photo).

Mead's milkweed (*Asclepias meadii*). The NRCS Plant Materials Program and the Manhattan PMC have made significant contributions to the conservation of America's natural resources and are eager to work with other agencies and organizations to provide vigorous prairie plant materials. The technical staff is available for presentations to various groups, training sessions, and on-site visits to land-owners. Technical notes, fact sheets, brochures, and other informational materials can be found at the PMC website: <http://plant-materials.nrcs.usda.gov/>.

#### **Wet meadow restoration at the Baker Wetlands**

Dr. Roger Boyd is Senior Professor of Biology and Director of Natural Areas at Baker University in Baldwin City, Kansas. He described restora-

tion and management on the Baker Wetlands, a 573-acre parcel located in the floodplain of the Wakarusa River on the south side of Lawrence. The area was historically part of what is now Haskell Indian Nations University and was largely plowed to teach European farming techniques to Indian youth. The land was later surplused and acquired from the federal government by Baker University in 1968. Additionally, a perimeter levee, major drainage canal, and lateral canals (referred to as W-ditching or bedding) were constructed and 26-in.-diam subsurface tiles were installed. Thus, the area was impacted in different ways through plowing, ditching, and canal construction. However, two virgin wet meadow tracts were intact but were still being drained.

The first 20 years after acquisition were dedicated to reverting the cultivated ground back into native grasses and wildflowers. Between 1991 and 1996 several grants from the U.S. Fish and Wildlife Service "Partners for Wildlife" program were used to reverse the drainage system that had been in place since the 1920s. A levee was constructed through the center of the area to increase hydration on the western side, and three water control structures were installed so that the area could be maintained as a wet meadow rather than an open-water wetland. Several pools were also created, artificial nesting structures were installed, and an observation blind and boardwalk were constructed to provide educational benefits for the public. Since 1991, more than 12 projects have been designed to restore native vegetation, re-hydrate the area, and provide interpretation; a variety of agencies, organizations, and private donors sponsored these projects.

The northwestern portion of the complex, consisting of 140 acres, was designated as the primary wet meadow restoration area. This tract was surveyed before the first manipulation and subsequently at five-year intervals to assess changes in biodiversity as the area was re-hydrated. By 1995 hydrophytic vegetation had returned to much of the area, as was evidenced by stands of bur marigold (*Bidens polylepis*), an obligate wetland species. A monitoring program was initiated in 1991 and consisted of observation wells installed to monitor water tables; surveys of rodents, birds, and reptiles and amphibians to assess diversity; and sampling of vegetation in the northwest quadrant and comparison of data with the southwestern virgin wet meadow.

Although the Baker complex is relatively small, results of restoration and management efforts show how a site can be improved with careful design and the dedication of cooperating partners. Baker Wetland projects were funded by a wide range of agencies, organizations, and benefactors including the USFWS Partners for Fish and Wildlife Fund, USDA Natural Resources Conservation Service, Environmental Protection Agency, Jayhawk Audubon Society, Sierra Club – Wakarusa Group, Ducks Unlimited, Quail Unlimited, Kansas Department of Wildlife and Parks, Westar Energy – Green Team, Hey Machinery Company, and many private donors.

### Synopsis of site visits

Field activities for the workshop were coordinated by Mike Watkins and his ranger staff from projects in the Kansas City District. The August 15 field trip included stops at Fort Riley, Tuttle Creek Lake, and Milford Lake. En route to the Carnahan Park Prairie at Tuttle Creek Lake participants passed through an extensive unbroken prairie that was included in the proposed Tall Grass Prairie National Park. The Carnahan Prairie includes over 100 acres of unbroken prairie and is one of the largest contiguous tallgrass prairie tracts owned by the Corps of Engineers. The site is managed as an outgrant by Potawatomie County.

At Fort Riley, Gibran Suleiman, Natural Resource Specialist, gave a tour of areas that have been intensively managed to improve habitat for greater prairie chickens (*Tympanuchus cupido*) and Henslow's sparrows. Biologists at the Fort have used mechanical means as well as fire to remove woody vegetation and improve large expanses of native prairie. Additionally, the prairie restoration program has been expanded to include private lands in close proximity to the Fort on an 80/20 cost share basis.

Tuttle Creek Lake, located in the famed Flint Hills of Kansas, is encircled by vast unbroken tracts of tallgrass prairie, and is the premier prairie project in the Kansas City District (Figure 13). Although Tuttle Creek Lake itself supports only 1,500 acres of prairie, it borders the original proposed site for the Prairie National Park and is considered a section of the picturesque Prairie Parkway. Paul Weidhaas and Brent Logan guided a tour of the project and discussed prairie management challenges such as limitations to prescribed burning and control of non-native invasive plants. At Milford Lake, prairie habitat was viewed that had been heavily



encroached upon by woody vegetation due to past management. The prairie ecosystem is being restored on the project by using a combination of management strategies, including tree and shrub removal, mowing, haying, spot spraying with herbicides, and prescribed burns. Project personnel demonstrated mechanical removal of small trees with the specially designed “Kansas Clipper” (Figure 14).



Figure 13. Tuttle Creek Lake is the premier prairie site in the Kansas City District (Pam Bailey photo).



Figure 14. Removal of woody vegetation with the Kansas Clipper (Pam Bailey photo).

On the afternoon of 16 August workshop attendees were treated to a site visit of the internationally acclaimed Konza Prairie, led by Valerie Wright, Environmental Educator and Naturalist for the Konza Prairie Biological

Station (KPBS). The KPBS is an 8,600-acre native tallgrass prairie preserve owned by The Nature Conservancy and Kansas State University (KSU) and operated as a field research station by the KSU Division of Biology. The station was established with three main goals: long-term ecological research with a primary focus on the interactions of climate, fire, and grazing; education of the public and future ecologists; and conservation of the tallgrass prairie. KPBS personnel described prairie features, climate research, controlled burning techniques, grazing strategies, and burning/grazing interactions and frequencies on experimental plots. Grazing experiments conducted with approximately 200-250 head of American bison (*Bos bison*) were of particular interest (Figure 15). For additional information refer to the Konza Website:

<http://keep.konza.ksu.edu/>.



Figure 15. The Konza Prairie conducts long-term grazing experiments with American bison (Mike Watkins photo).

### 3 Workshop Follow-up

Considerable follow-up actions resulted from the workshop, including several news releases, bulletin articles, conference presentations, and e-mail responses from Corps participants. Follow-up responses and actions are summarized below.

#### Workshop responses

Informal responses to the workshop were provided by several participants. Carey Weber, Georgetown Lake Manager, distributed an e-mail summary of the workshop to Corps project personnel in the Fort Worth District. He provided an overview of the presentations and stated that both diversity and commonality were represented. Weber emphasized that partnering was common to almost all of the programs, and included agencies and organizations such as the NRCS, USFWS, The Nature Conservancy, county and state agencies, cattlemen's associations, and local fire departments. Conflicting management philosophies was a recurrent theme, and included changes in Corps management priorities, as well as outgrants for agricultural leases and wildlife management. Various management strategies were discussed. Weber emphasized that prairies are disturbance-driven systems, relying on fire to prevent woody species' invasion. Encroachment by woody species was the primary management challenge discussed, but managers must understand that prescriptions should be site-specific because prairie communities vary regionally and within regions. Invasion of exotic non-woody plants is also a problem. Carey also discussed grazing practices and emphasized that appropriate stocking rates were critical to preventing the removal of prairie grasses such as eastern gamagrass (*Tripsacum dactyloides*), big bluestem (*Andropogon gerardi*), Indiangrass (*Sorghastrum nutans*), and little bluestem. Finally, Carey encouraged District and project personnel to become more active in prairie management and attend future workshops.

Don Wiese, Natural Resources Manager, Fort Worth District, responded to Cary Weber's e-mail as follows: "I came away with a reassurance that the Environmental Stewardship business line of the Corps is doing the right thing in examining the current status and future direction of managing native prairie on Corps lands. The workshop clearly demonstrated that most federal, state, and private conservation organizations are doing as

much as possible to save and protect the tiny remaining fragments of prairie. The effort is similar to that directed toward bottomland hardwoods...trying to protect a rare and valuable ecosystem, mostly without the benefit of federal law directing or mandating the effort. I think the Corps should, at a minimum, take the results of the workshop and ongoing research work units and consider incorporating language into our stewardship and master planning regulations which would specifically direct attention to the identification, restoration and protection of native prairie. The Healthy and Sustainable Lands performance measure could also be amended to provide this emphasis. In the end, designation of our native prairies as Environmentally Sensitive Areas in our project master plans, and giving high value areas recognition as national and natural landmarks, should be our goal.”

Douglas Cox, Operations Project Manager with the Elm Fork Project (Lewisville, Grapevine, and Ray Roberts Lakes, Texas) responded to Don Wiese and suggested that there should now be some momentum to identify a District prairie management/range controlled burning Product Delivery Team. He further suggested that the District should identify and catalog all of its controlled burning equipment (firefighting equipment, inter-seeders, tractors, etc.), supplies (foams, grass seed, nomex outer shells, etc.), materials, and expertise (personnel that can conduct range inventories and assessments, fire bosses, and other fire-trained personnel). Project personnel could then share resources and assist each other through regional planning and loaning of equipment and personnel to achieve successful prairie management within acceptable costs.

Ryan Williams, SCEP Park Ranger with the Wilson Lake Project, responded with some comments to the Kansas City District. One of the problems noted was the lack of communication and sharing of information among personnel dealing with similar problems or challenges. Although communication within districts is accomplished via meetings, e-mail, and phone messages, it is often difficult to identify the right person to contact for specific problems. Ryan suggested that something could be developed along the lines of a blog or forum within the Corps network on topics such as invasive species control. This would decrease the time needed to research an issue and increase efficiency at the project level. Drawbacks identified are that the blog or forum would have to be checked frequently, the network would have to be moderated, and personnel would need to be willing to routinely provide comments and suggestions on various aspects

of prairie management. Mike Watkins replied to Ryan's comment and stated that the Corps Natural Resource Management Gateway was designed to allow project personnel to share experiences and provide technical information to help solve specific issues. He acknowledged, however, that there is a problem with people not posting enough information about lessons learned, and emphasized the need to encourage greater use of the Gateway system.

Scott Rolfes with the Rock Island District e-mailed workshop coordinators and offered several comments. He responded to workshop statements regarding the need to identify advocates for Corps prairie management, and suggested that Corps personnel would be best served by becoming active members of local or regional organizations such as the Kansas "Tallgrass Legacy Alliance" and the "Iowa Prairie Network." Rolfes was especially curious as to why it was so critical to promote prairie restoration and management in the Corps of Engineers based primarily on the value of prairies in respect to water quality, soil stabilization, and flood reductions. He further stated "While all of these benefits are derived from prairie ecosystems, isn't it enough that North American tallgrass prairie as an ecosystem is one of the most endangered ecosystems on the planet? Corps-owned prairie resources are probably home to many of our endangered plants and animals. Long-term ownership and management of Corps prairies also make ideal locations for the transfer and recovery of species currently endangered by isolation."

Rolfes stated that he considered the most beneficial take-home message from the workshop was knowing that his program at the project level does not stand alone and that other field sites are doing some great things to protect prairies. It was comforting to see prairie work being done on Corps lands throughout the country. He further suggested that Corps personnel should consider presenting papers at the 2008 North American Prairie Conference and recommended that prairie management become a tract at the 2007 Corps Environmental Conference. He also thought that it would be a good idea for Corps prairie enthusiasts to meet periodically to share information, perhaps forming an in-house prairie alliance. Rolfes concluded by emphasizing that control of invasive species was critical to successful prairie management and should be a focus area for research and technology transfer.

## Bulletins and news releases

Eric Cramer, Public Affairs Office, Kansas City District, attended the workshop and prepared a summary of presentations and events that was shared with District and Division offices. The first article by Cramer (2006a) appeared in Kansas City District's news magazine *Heartland Engineer*. A follow-up article by Cramer (2006b) was published in the September 2006 issue of *It's Your Business*, a newsletter of the North-western Division Regional Business Center. The event was later summarized in the October 2006 issue of *Engineer Update* (U.S. Army Corps of Engineers (USACE) 2006).

## Presentations at other workshops and conferences

Since the workshop, Corps personnel with ERDC, District/Division, and project offices have given presentations on prairie restoration and management at a variety of meetings and workshops. Prairie presentations by other-agency specialists have also been given at Corps workshops and training sessions. The March 2007 Annual NWD Fish and Wildlife Biologists Workshop held in Richland, Washington, included the following presentations:

- "Hanford Monument Grassland Restoration" by Heidi Newsome, USFWS, Mid-Columbia River Refuges Complex
- "Genetic Considerations in Prairie Restoration" by Wes Messinger, Willamette Valley Projects, Portland District
- "Cooperative Effort to Manage Noxious and Invasive Species" by Patricia Gilbert, Fort Peck, Omaha District
- "Prairie Ecosystem Management and Partnerships for Implementing Prescribed Burns" by Dan Hays, Wilson Lake, Kansas City District

The following prairie papers were delivered at the Corps of Engineers Environmental and Natural Resources Conference held in San Antonio, Texas, on 29 Oct-01 Nov 2007:

- "History of Prairie Management in the Kansas City District" by Mike Watkins
- "Managing Willamette Valley Prairie Ecosystems" by Wes Messinger
- "Managing Sensitive Species with Fire" by Randall Becker
- "An Assessment of Prairie Ecosystems on Corps of Engineers Projects" by Chester Martin, Pamela Bailey, and Paul Peloquin

Other presentations made at miscellaneous conferences and workshops are as follows:

- “Status of Grassland Ecosystems on Corps of Engineers Project Lands.” Presented by Pamela Bailey at the 2006 North American Prairie Conference, August 2006 in Kearney, NE. The associated paper was later published in the symposium proceedings (Martin et al. 2008).
- “Prairie Restoration and Management on Corps of Engineers Project Lands.” Presented by Chester Martin at the Annual Meeting of The Wildlife Society, September 2007 in Tucson, AZ.
- “Native Plant Research at the U.S. Army Research and Development Center,” Presented by Pamela Bailey at the November 2007 bi-monthly meeting of the Plant Conservation Alliance in Arlington, VA.

Prairie research and management efforts within the Corps were discussed at the Plant Conservation Alliance (PCA) meeting. This included an overview of grassland acreage on operational projects, results of the Corps prairie workshop, availability of EMRRP Technical Notes on prairie ecosystems, and prairie restoration and management activities at various Corps projects. The PCA, composed of federal agencies and conservation organizations, provides a framework and strategy for linking resources and expertise in developing a coordinated national approach to plant conservation.

## **4 The Future of Prairie Restoration and Management on Corps Projects**

Results of the current EMRRP prairie work unit have shown that prairie ecosystems contribute significantly to natural resource stewardship goals on Corps operating projects. The Corps-wide prairie/grassland data call revealed that at least 21 Districts and 172 projects throughout the Corps are involved to some extent in prairie restoration and management. Based on District and project input, more than 790,000 acres of prairie/grassland habitat were estimated to occur on Corps projects. Additionally, presentations by Corps personnel at the Corps Prairie Workshop and other workshops and conferences have showcased exceptional efforts to restore and manage prairie ecosystems on many projects. Nevertheless, support for ecosystem restoration and management of upland prairie/grassland areas is generally lacking in the Corps of Engineers.

Primary objectives of the work unit have been accomplished. The project survey was completed in 2005 (Martin and Peloquin 2005), and the Corps Prairie Workshop was accomplished in 2006. Full accounts of workshops were posted on the Corps Gateway website. An article on the status of grassland ecosystems on Corps lands was published as a peer-reviewed manuscript in the proceedings of the 2006 North American Prairie Conference (Martin et al. 2008). Technical Notes have been published on planting techniques and maintenance requirements (Bailey and Martin 2007a), the regional availability of plant materials for prairie restoration (Bailey and Martin 2007b), and prairies and water management (Bailey 2009). This report satisfies the requirement to publish a proceedings of the 2006 technical workshop and provide a summary of lessons learned.

The 21<sup>st</sup> North American Prairie Conference (NAPC) was held in Winona, MN, on 4-8 August 2008. The theme of the 2008 conference was “The Prairie Meets the River” and this conference represented an excellent opportunity to showcase Corps research and management efforts. Kurt Brownell, Natural Resources Specialist, St. Paul District, presented a paper titled “Sand Prairie Ecology and Restoration on Army Lands.” He also led a field trip to the District’s sand prairie restoration site



(Figure 16) and adjacent Sand Prairie at Weaver Dunes, owned by The Nature Conservancy. Corps personnel also held a separate meeting during the conference to discuss progress, products, and future needs regarding prairie restoration. Pamela Bailey (ERDC) led the meeting; participants included Scott Rolfes and Tyler Hill (Saylorville Lake) and Wayne Morton (Missouri Prairie Foundation). Major issues resulting from the meeting are summarized below:

- The Corps needs to improve efforts to identify sensitive project lands, including prairie remnants.
- Memoranda of Understanding (MOUs), Memoranda of Agreement (MOAs), Handshake Partnership Agreements, and other partnering mechanisms should be investigated so that Corps and non-Corps entities can form effective partnerships in the future. Partnerships can be formed for performing prescribed burns, sharing equipment, obtaining plant material and seed, and other restoration purposes.
- To continue the prairie dialogue, natural resources personnel should be encouraged to present papers and hold meetings at future prairie conferences; the next NAPC will be held in Iowa in August 2010. It would also be worthwhile to consider holding a prairie session at the next Corps Natural Resources and Environmental Management Conference.
- The Natural Resource Gateway is probably the most effective place to share prairie information among prairie restoration practitioners. Project personnel should be encouraged to provide input to the website.

With the existing effort coming to a close, the future of prairie restoration and management on Corps lands must now be examined. One of the major contributions of the EMRRP work is that it has heightened the visibility of prairie lands in the Corps and has brought attention nationwide to exceptional management programs conducted on many projects. It is worthwhile to note that most actions have been carried out with limited funding and with the support of a diversity of local and regional partners. Corps personnel involved with prairie projects have emphasized the need to coordinate and collaborate with agencies and organizations such as the



Figure 16. Sand prairie restoration using dredged material from the Mississippi River (Pam Bailey photo).

USFWS, NRCS, TNC, and prairie alliances. Additionally, it was stressed that natural grasslands were highly variable regionally and from site to site, and proper management could not be accomplished using a cookbook approach.

A variety of issues and challenges for prairie management were identified at the Corps workshop and in follow-up correspondence with District and project personnel. These concerns are in need of further attention either through research actions, on-site experimentation, technology transfer from within and outside the Corps, and policy development at the District, Division, and Headquarters levels. Major issues and needs are summarized as follows:

- Conflicting management philosophies and priorities need to be addressed at all levels within the Corps of Engineers. Adequate funding needs to be available for managing existing tracts of prairie and restoring potential sites on project lands. It should be recognized that grassland management and control of invasive woody species such as salt cedar (*Tamarix* spp.) and honey mesquite (*Prosopis glandulosa*) will improve habitat value and water yield on operational projects.
- Authorities for prairie restoration and management may need to be clarified and further defined. However, Corps decision makers should

understand that grassland management on Corps projects is included within the mandate of the Forest Cover Act, which states that the Corps will provide for the protection and development of vegetative cover other than forests and woodlands as well as establish conservation measures for its maintenance. It further states that management techniques will be applied whenever the opportunity exists to protect native grasslands or prairie and improve vegetative conditions as a means of practicing soil conservation, watershed protection, fish and wildlife habitat, or range management.

- Better technology is needed to assist with control of invasive species, including both native and exotic herbaceous and woody species. Although the Corps has had a long-standing program dealing with control of invasive aquatic plants, information and technical guidelines on the control and management of upland plants are lacking.
- Many projects are using prescribed burning to maintain prairie ecosystems and control invasive species. However, projects that are new to fire management are in need of guidance from projects with experience and expertise. It would also be worthwhile to identify equipment and materials available among projects; this would allow items to be shared and reduce operating costs. Additional work is also needed to evaluate burning frequency and seasonal differences.
- Grazing practices need to be thoroughly examined on Corps projects. Existing evidence indicates that appropriate grazing strategies are compatible with prairie management objectives, whereas improper grazing (e.g., overgrazing, seasonal grazing over sustained periods) is highly destructive to native grasslands. Studies need to be conducted to evaluate the interaction of grazing, burning, and mechanical treatments on project lands.
- Guidelines need to be provided on how to best communicate with the public and deal with uninformed critics of prairie restoration and habitat management. Several workshop attendees stressed that interaction with public interests was critical to avoid criticism and adverse reaction to management efforts. This is especially the case with respect to controlled burning and management of Corps lands in close proximity to private property.

- Recommendations need to be provided on how to deal with state and other federal agencies that may have conflicting management priorities. This is especially the case with state agencies that are responsible for managing Corps lands according to outgrants and other types of lease agreements.
- Many projects would benefit from additional information on the most appropriate grasses and herbaceous species and cultivars to establish on their projects. Project personnel often must depend on stock provided by NRCS Plant Material Centers or commercial suppliers, but occasionally non-native materials are provided that are not the best species to use for creation of native prairie.
- There is a critical need to conduct thorough inventories of existing grasslands on Corps projects. Surveys are needed to identify the types of existing or potential prairie present, determine species composition of representative tracts, and assess the condition of existing grasslands. This need is consistent with Engineer Regulation (ER) 1130-2-540 (U.S. Army Corps of Engineers (USACE) 2005), which mandates that natural resource inventories be conducted on all operational projects. Presently, projects are required to classify and quantify vegetation acreage (to the subclass level) for Level I Natural Resource Inventories in accordance with the Federal Geographic Data Committee National Vegetation Classification System (NVCS) (Krause et al. 2004, Martin et al. 2006). However, more detailed surveys may be required to develop appropriate management strategies.
- There needs to be a concerted effort to improve communication within and among Districts. Better communication and exchange of technical information can be accomplished through periodic in-house workshops, such as the annual Fish and Wildlife Biologists Workshops sponsored by NWD. The Corps Gateway website should also be used more extensively, and project personnel should routinely contribute information (especially details on what works and what doesn't work on their individual projects).

Prairie restoration and management throughout the Corps has gained considerable momentum over the past three years, due in large part to accomplishments of the EMRRP work unit and efforts of the SAT. In future years the SAT will need to take the lead to ensure that prairie

management is recognized as a Corps function and receives the proper attention at the Headquarters level. Ultimately, it will be a responsibility of the Districts and projects to continue to promote programs to restore and maintain high quality prairie lands on their projects.

## 5 Conclusions

Corps of Engineers operational projects represent a diversity of habitats and landscape features throughout the country. Although natural resource management activities on Corps projects have traditionally focused on aquatic and wetland systems, virtually all project lands include substantial acreages of riparian areas, wooded uplands, and open grassland ecosystems. A data call conducted as the initial task for the present study revealed that at least 21 Districts and 172 projects were involved in prairie/grassland restoration and management. Acres of grassland habitats on project lands included the following, tallied according to Corps Divisions: Northwestern Division (603,476 acres), Southwestern Division (95,037 acres), South Pacific Division (21,295 acres), Great Lakes and Ohio River Division (2,821 acres), Mississippi Valley Division (25,755 acres), South Atlantic Division (3,048 acres), and North Atlantic Division (790 acres), for a total estimated area of 790,106 acres nationwide. These findings indicate that there is a need for greater attention to grassland ecosystems on Corps lands at all levels within the organization.

A Corps-wide prairie workshop held on 15-16 August 2006 in Manhattan, Kansas, further revealed the importance of grassland habitats on project lands and showcased exemplary prairie restoration and management activities on projects from several Districts. Presentations were made by Corps personnel representing ERDC, Northwestern Division, Kansas City District, Fort Worth District, Little Rock District, Portland District, U.S. Fish and Wildlife Service, Natural Resources Conservation Service, Kansas Natural Heritage Inventory, and Baker University. Additionally field trips were taken to visit prairie restoration sites at two Corps projects in the Kansas City District, Fort Riley Army installation, and the internationally acclaimed Konza Prairie Biological Station. Presentations included descriptions of a variety of issues, strategies, and practices for improving prairie habitat on project lands, including site conversion techniques, prescribed burning, grazing issues, control of invasive plant species, managing populations of rare and endangered species, grassland management at urban lakes, protection of existing remnant prairie habitat, developing partnerships, and conflict resolution within and among agencies and private interests.



It was apparent from the workshop presentations and interaction among participants that Corps personnel have been involved in efforts to protect and improve prairie ecosystems for many years. It was also obvious that project personnel have developed innovative methods to accomplish prairie restoration, and many projects have formed partnerships with other agencies and organizations to accomplish management objectives. Many of the management activities described have resulted in significant improvements to the condition of project lands and sustainable use of those lands by the public. Prairie restoration practices have not only improved wildlife habitat, and provided outdoor recreation benefits (e.g., sport hunting, nature study), but have resulted in substantial improvement to water quality, and control of invasive species. Several projects have become major players in protecting remnant populations of endangered plant species considered significant at both the state and federal level.

Results from the prairie work unit and workshop have shown that prairie ecosystems contribute significantly to natural resource stewardship goals and are important to overall ecosystem health on Corps operating projects. Although prairie restoration benefits are often recognized at the project level, many issues need to be addressed at District, Division, and Headquarters levels. Needs identified during the workshop and follow-up coordination with District and project personnel include (1) a need for resolving conflicting management philosophies regarding grassland ecosystems, (2) provision of adequate funding for restoration projects, (3) clarification of authorities for prairie restoration and management, (4) provision of better technology for controlling invasive species, (5) information exchange regarding prescribed burning and availability of equipment, (6) examination of grazing practices, (7) provision of guidelines on communicating with the public, (8) provision of recommendations on how to resolve management conflicts with state, local, and other federal agencies, (9) provision of information on planting mixtures and available cultivars, (10) completion of thorough inventories of existing grasslands on Corps properties, and (11) improvement of communication within and among Districts, especially through technology transfer mechanisms such as the Corps Gateway website.

As a final note, Corps personnel on projects throughout the country are to be congratulated for significant contributions to prairie restoration at the local, state, and regional level. Results of the Corps Prairie Workshop

showcased only a fraction of prairie improvement activities carried out by project personnel, and there is much more to be learned from other projects. Thus, project managers and natural resource specialists are encouraged to share their activities and accomplishments with the Corps family at-large, by submitting information to the Corps Gateway website and other information exchange media.

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## **Appendix A: Summary of Prairie/Grassland Acreage on Corps of Engineers Projects**

Corps District/Division	Number of Projects Reporting Acreage	Acres of Prairie/Grassland
<b>Northwest Division</b>		
Portland District	1	303 acres
Seattle District	3	785 acres
Walla Walla District	8	29,106 acres
Omaha District	9	539,425 acres
Kansas City District	16	33,857 acres
<b>TOTAL – NWD</b>	<b>37</b>	<b>603,476 acres</b>
<b>Southwestern Division</b>		
Fort Worth District	19	31,524 acres
Tulsa District	24	52,860 acres
Little Rock District	3	10,653 acres
<b>TOTAL – SWD</b>	<b>46</b>	<b>95,037 acres</b>
<b>South Pacific Division</b>		
Sacramento District	8	14,475 acres
San Francisco District	1	2,480 acres
Albuquerque District	2	4,340
<b>TOTAL – SPD</b>	<b>11</b>	<b>21,295 acres</b>
<b>Great Lakes and Ohio River Division</b>		
Huntington District	3	499 acres
Louisville District	11	2,174 acres
Nashville District	2	148 acres
<b>TOTAL – GLORD</b>	<b>16</b>	<b>2,821 acres</b>
<b>Mississippi Valley Division</b>		
Rock Island District	5	7,542 acres
St. Louis District	6	30,123 acres
St. Paul District	8	4,149 acres
Vicksburg District	10	21,825 acres
<b>TOTAL – MVD</b>	<b>29</b>	<b>63,639 acres</b>
<b>South Atlantic Division</b>		
Mobile District	4	2,100 acres
Wilmington District	3	948 acres
<b>TOTAL – SAD</b>	<b>7</b>	<b>3,048 acres</b>
<b>North Atlantic Division</b>		
New England District	26	790 acres
<b>GRAND TOTAL</b>	<b>172</b>	<b>790,106 acres</b>

